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Web-Based Blood Bank Application

Kaushal Sakalle[1], Pratik Uchitkar[2], Kuldeep Sapate[3], Dr. Sushma Telrandhe[4]

[4]HOD, Dept. of Computer Science and Engineering, Guru Nanak College Of Engineering and Technology, Rashtrasant Tukdoji Maharaj University, Dahegaon, Kalmeshwar Road, Nagpur-441501,India.
[123]Student, Dept. of Computer Science and Engineering, Guru Nanak College Of Engineering and Technology, Rashtrasant Tukdoji Maharaj University, Dahegaon, Kalmeshwar Road, Nagpur-441501,India.

Abstract - *Blood donation plays a crucial role in the field of medical science and healthcare. Ensuring the smooth and stable supply of all the specific blood groups is the main key role of all the blood bank and their substitute centers. But in traditional blood donation system many problems are been faced to found blood banks and donor unavailability. But now in this era of technology we explores the role of internet and web based application which helps to find blood donor and blood banks. This paper addressing the importance of web based blood bank application. It discuss the key features, implementation, user interaction and management, and finally donor engagement and solutions. One can find the blood of the needed blood group on time without facing hustle.*

Key Words: **Blood Donation · Blood Bank · Blood Donor · Blood Supply · Blood Testing, Blood Recipient, Blood Inventory.**

1. INTRODUCTION

The timely availability of blood without any hustle can be the difference between life and death in medical emergencies. However, traditional blood bank management systems are often plagued by inefficiencies such as delays in donor-recipient matching, outdated inventories, and lack of coordination among hospitals and blood banks. In rural area this is the biggest problem ever. With the advent of internet technologies, web-based applications have emerged as powerful tools to improve healthcare systems by enhancing accessibility, real-time communication, and data management. A web-based blood bank application is designed to connect donors, recipients, and blood banks in a centralized manner, easily accessible platform. This research explores the development, benefits, and implementation challenges of such a system. With the rise of the internet in the 1990s and the growth of web development technologies in the 2000s, web-based systems started replacing traditional models. In recent years, many countries have begun adopting digital blood bank management systems, and public awareness. After the development of web-based application the percentage of death due to blood is decreased .Web-based applications have the potential to stable the condition of blood and donor unavailability. From this blood bank application finding of donor and blood banks and the interaction between donor, blood bank and the blood recipient is much more efficient.

1.1 Definition of Web-based Blood Bank Application

A Web-Based Blood Bank Application is to be designed to manage the operations of a blood bank, including donor registration, blood inventory management, donor data management, blood request processing, searching for a needed blood and communication between donors, recipients and blood banks. These systems are typically accessible through a web browser and often include features such as

1. Sign-up as a Donor.
2. Create Account by filling all the necessary details.
3. User-login.
4. Geographic search for nearby donors or blood banks
5. Or generate request for blood needed.
6. Donor eligibility tracking and reminders.
7. Upcoming blood donation camp.

1.2 Key Terms and Concepts

Blood Bank is a facility where blood is collected, stored, processed, and distributed for transfusions. It play a crucial role to motivate people to become donor, making proper schedule for donor to donate blood in the specific time period, collection of blood, storing of blood, and distribution are the main terms. A proper management of data is the main key that how to handle data of donors, receivers of blood, hospital and many more. The blood recipient should also be an authorized user and donor too. Then one can easily made a request for its blood need. Inventory management is also the crucial concept which process of managing and storing the stock of available blood units categorized by blood type, R H factor, and expiration date. As per the schedule alerts sent to donors or hospitals when blood of a specific type is needed or available. Donor can donate blood at the particular blood bank and the recipient also go through the blood bank or can directly get in contact with donors.

2. RELATED WORK

The related work includes all the necessary information, working pattern, blood storage management, new lab technologies in blood testing, blood donor data, updating databases, updating servers, user interface updates, admin interface update, blood bank data and location upcoming

events , blood request, recipient data are some crucial related work of web based blood bank Application. The emergence of this web based application plays a crucial role in medical and healthcare field. It's made a bridging between the donor, blood bank, recipients and hospitals. One can easily access the application and found the blood on time which in needed. This application brings a boost in blood donation activity and awareness among people to donate blood periodically.

Despite these efforts, many existing systems suffer from limitations such as lack of interoperability, poor user interfaces, limited real-time integration with blood banks, or insufficient emphasis on data security and user privacy.

Many systems and application has facing the insecurity between the donors and recipient and also having the issues of their personal data. Furthermore, few systems offer features such as automated matching of blood types between donors and recipients, geolocation-based donor discovery, or mobile-responsive interfaces for wider accessibility. In contrast, the proposed system aims to overcome these challenges by implementing a responsive web application with a user-friendly interface, real-time blood inventory updates, secure login mechanisms, and a donor-receiver matching algorithm based on location and blood type. This solution not only facilitates efficient communication between donors, hospitals, and blood banks but also enhances the visibility and accessibility of blood donation services. Because of this web-based blood bank application it is very easy to find the specific blood on time without any hustle.

3. SYSTEM ARCHITECTURE AND METHODOLOGY

The proposed system follows a client–server architecture implemented as a web-based application, emphasizing modularity, usability, and secure data management. The design ensures that user interaction, data processing through APIs are handled through distinct layers, thereby maintaining scalability and data integrity. The Various APIs are used to sign-up, log-in,

to put data, to get donors data, to find all the registered donors, to delete the donors and so on from the database. The various tasks are performed by the APIs created in the backend programming which is the backbone of the entire application which is connected to the frontend and to the database. Client can easily and flexibly handle the user-interface from which they put and get the desire data all these tasks are performed by the backend which is routed to the frontend application. The user-interface is also being flexible to use and handle. The same interface is visible to all the clients or donors. This is the one page application which work is components for better and fast access.

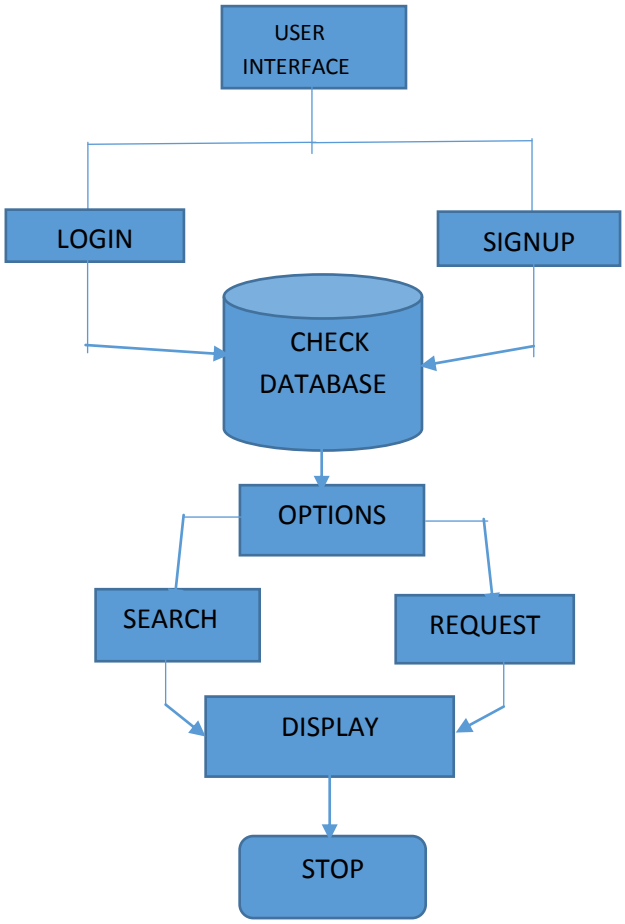

Figure 1: Architecture of the web based blood bank application.

3.1 Data Input: Users interact with a web interface to provide relevant blood information. This can be achieved either by completing a online sign-up form by giving all the necessary data and report of blood group and major test including Gmail, contact no. and residential address.

3.2 Backend Processing: Upon submission, the input data is securely transmitted to the backend via encrypted communication channels. The backend server includes a dedicated API endpoint capable of handling multipart form data, effectively managing both textual and image-based inputs.

3.3 Inference: The request of the specific blood group is sent to the database and user got all the detail of donor and blood bank too. One can do direct interaction with the donor to because the data base holds the contact information of the donor.

3.4 Specification: All this accessed through a secure API. The application natively supports the entire API

With JWT (JSON WEB TOKEN) which provide authentication and authorization which makes the data secure.

3.5 Output Delivery: After searching for the specific blood group the donor list will appear on screen with all the necessary details from which recipient can contact directly or by make contact through blood bank.

3.6 Backend Development

The backend infrastructure was implemented using JAVA in conjunction with the Spring boot framework, providing a lightweight yet robust environment optimized for scalability and efficient request handling. A single Restful API endpoint, /analyses, manages all incoming client requests, ensuring a streamlined communication flow between the frontend and backend. Sign-up Form uploads are processed using the Restful API which facilitates handling of multipart/form-data requests and supports.

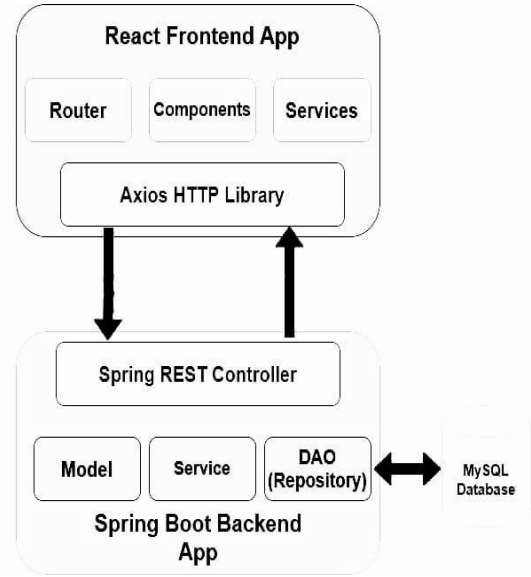

Figure 2: Data flow and showing connection of React Frontend App with Spring Boot Backend App and My SQL Database.

3.7 Frontend Development

The frontend is designed as a minimalist single-page application (SPA) built with standard React application, CSS, JavaScript prioritizing performance and accessibility. A dark-themed visual design was adopted to reduce eye strain and align with contemporary web aesthetics. The interface organizes user interactions into distinct sections for manual data entry and file uploads, promoting clarity and ease of use. Backend communication is handled asynchronously via the fetch API, enabling non-blocking requests and real-time feedback. During model inference, a dynamic loading indicator provides progress visibility, and upon completion, the interface displays secure download links for the generated reports—all without requiring a page reload, thereby enhancing user experience and responsiveness.

3.8 Data Flow and Security

Once data submission occurs, the data is submitted in the JSON format but in MySQL database all the register user data are stored in table format. Before submitting the data server hold the data for a specific period and send it to database with the help of API which are created in backend. It extracted data from the server, effectively safeguarding patient privacy and ensuring compliance with secure data management practices.

4. RESULT

The development and the implementation of the web-based blood bank application were successfully completed the system was tested for functionality, usability and performance. The results demonstrate the system's ability to meet the objectives outlined in the research. The various test are done before it as functional testing as user registration/login, donor management, search and request blood group, admin panel. A usability test was also conducted with some donor recipients and admin. A performance evaluation is also done which is based on system response time and load testing, response time and uptime. As per we discuss in the abstract and introduction the same result we got after research and developing the web based blood bank application.

4.1 Response Time: The duration between a user's request (e.g., searching for O-negative blood) and the system displaying the results. In optimized systems, this is typically under 2–3 seconds.

4.2 Throughput: The number of concurrent users the application can handle. High-performance systems are designed to support hundreds of simultaneous requests without a drop in speed, especially during local disasters or emergencies.

4.3 Data Integrity: Ensuring that the blood stock count is updated instantly ($real-time$) without errors. If 1 unit is issued, the database must reflect this immediately to prevent double-booking.

4.4 Resource Utilization: How efficiently the system uses CPU and Memory. A well-designed application should maintain low server overhead to ensure 24/7 availability.

5. CONCLUSION AND FUTURE WORK

5.1 Conclusion: This study presented a proof-of-concept that web-based blood bank application designed to support and play vital role in medical and healthcare. This research presented the design, development, and evaluation of a web-

based blood bank application aimed at enhancing the efficiency, transparency, and accessibility of blood donation and distribution services. The system successfully addressed key challenges in traditional blood bank management, such as delayed request processing, lack of real-time inventory tracking, and limited donor engagement. By developing this web-based application the founding of donor, blood bank is very convenient. The development of this web-based blood bank application successfully demonstrates the integration of a modern **React.js** frontend with a robust **Java (Spring Boot)** backend to solve the critical challenges of traditional blood management. By transitioning from manual record-keeping to an automated digital ecosystem, this system significantly reduces the "search-to-delivery" time, which is paramount during medical emergencies. In conclusion, the proposed system is not merely a database management tool but a life-saving digital intervention. It optimizes the blood supply chain, enhances donor engagement through a user-friendly interface, and provides a scalable framework that can be integrated with national healthcare registries. Future enhancements could include the integration of AI-based demand forecasting and GPS-enabled real-time donor tracking to further refine the efficiency of emergency responses.

5.2 Future Work:

1. AI-Driven Demand Forecasting

The next phase of this project could involve integrating Machine Learning (ML) models. By analyzing historical data of blood usage (e.g., higher demand during specific months or following local accidents), the system could predict future requirements. Java-based libraries like Weka or Deeplearning4j could be used to implement predictive analytics, allowing blood banks to organize donation camps proactively before a shortage occurs.

2. Integration with IoT for Smart Inventory

Future iterations could leverage the Internet of Things (IoT) to monitor blood storage conditions. Smart sensors connected to the Java backend could provide real-time updates.

3. AI-Driven Blood Health Analysis.

4. Integration with all the small scale blood bank in rural area for betterment of blood donation on time.

5. Iot based new machinery used in blood diagnosis and for storage.

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